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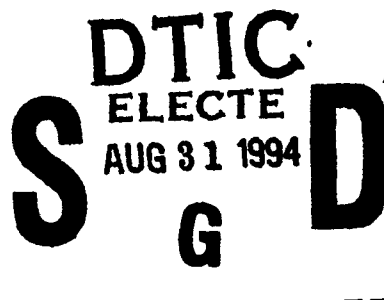
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ADST
Operators/Users Manual
for the
BDS-D VIDS-equipped M1

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13. ABSTRACT (Maximum 200 words)

This document provides information describing usage and operations of the Vehicle Integrated Defense System (VIDS) equipped M1.

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TABLE OF CONTENTS

1.   Introduction

This document provides an overview of the operational concept for, and usage of, the BDS-D VIDS-equipped M1 tank simulator.

2.   Referenced Documents

2.1 Government documents

a.   ICD for VIDS for Componer. Advanced Technology Test Bed (CATTB), October 28. 1992.

b.   VIDS Armored Vehicle Surviva !it/ Equipment M1 Tank Simulator of BDS-D Functional Specifications, 29 May, 1992.

2.2 Non-Government documents

a.   Loral: BDS-D VIDS Feasibility Analysis Report, 14 October 1992.

b.   Loral: Operator Training Manual for the Bradley Fighting Vehicle Integrated Defense System, 12 May 1992.

c.   Loral: Software Design Document for the BDS-D VIDS-Equipped M1, 11 July 1993.

d.   Loral: Software Maintenance Manual for the BDS-D VIDS-Equipped M1, 11 July 1993.

3.   Overview

The BDS-D VIDS system was designed to enhance vehicle survivability through a set of functions that: a) sense threats; b) alert crew of threats; c) classify threats; d) select and control countermeasure responses; and e) respond to threats.

The VIDS system augments the basic SIMNET M1 vehicle simulator by simulating one or more of following threat warning sensors and countermeasures:

a.   Laser Warning Receiver (LWR). The LWR gives an audible warning when the M1/VIDS is lased at by enemy vehicles or laser designating/beam-rider ATGMs, and displays an icon representing the threat location relative to the M1/VIDS hull position.

b.   Missile Warning System (MWS). The MWS gives an audible warning when a missile is headed for the M1/VIDS and displays an icon representing the threat location relative to the M1/VIDS hull position.

c.   Missile Countermeasure Device (MCD).   The MCD jams the approaching missile's targeting platform to keep the missile from hitting the M1/VIDS tank.

d.   Multi-Salvo Grenade Launcher (MSGL)/Rapid Obscuration System (ROS). The MSGL/ROS launches smoke grenades to allow the M1/VIDS tank to find cover and concealment.

e.   Counterfire. Counterfire is the fastest response to threat vehicles and air craft. Counterfire performs a quick turret rotation to the area of the threat.

The BDS-D VIDS software can be operated in automatic, semi-automatic, or manual modes.

3.1   VIDS Initialization

To activate the VIDS system, first perform a normal M1 power up sequence: Turn Master Power On, Turn Engine On, Turn Turret Power On. Turret power must be on for VIDS to activate. At this point the initialization of the VIDS software in both the vehicle and the VIDS Commander's Control and Display Console is automatic. Once initialized, the VIDS software can be operated in automatic, semi-automatic, or manual modes. To reset the CCDP, while tank is running, toggle the turret power switch off then back on.

3.1   Manual Mode Operations.

After initialization, the VIDS system is in Manual Mode. In manual mode, operations inherent to the vehicle are performed, and include weapon/grenade and turret drive controls. Manual control is maintained regardless of whether VIDS is off, inactive, or experiencing a catastrophic failure (i.e., you will always have manual control capabilities within the tank). In the manual mode, if an incoming threat is detected by a configured sensor, VIDS will not dispense countermeasures. However it will sound a threat warning tone in the crew headsets and display a threat icon depicting the direction to the threat, relative to the hull of your tank.

3.2   Semi-Automatic Mode Operations.

When in Semi-Automatic mode, countermeasure and scanning functions are only active when the Tank Commander (TC) holds in the palm switch on the commander's control handle. Semi-automatic capabilities includes counterfire (target cueing), dispensing smoke, or scanning.

3.3   Automatic Operations.

Automatic mode is a "hands-off mode whereby all actions are taken by the VIDS software, without any intervention by the TC.

4.   Description of the Commanders Control and Display Panel (CCDP).

The CCDP is operated by the TC and provides the primary operational interface to the BDS-D VIDS system. The remainder of this document will focus on operations relating to use of the CCDP. The CCDP is a 0386 PC-based tactical display system implemented in a manner that emulates the Bradley VIDS Operator Control Console (OCC) documented above, in reference 2.2.b.

4.1 CCDP Outputs.

4.1.1 Basic Display Format.

Figure 4-1 illustrates the CCDP basic display format and associated icons. The following are basic CCDP display definitions:

- The BDS-D VIDS CCDP is non-directional (i.e., the top of the display does not represent north or the bottom south). However, the top of the VIDS display screen does represent the front of the vehicle's hull.

- The Hull pointer is always stationary - does not rotate when the tank neutral steers.

- The Turret Pointer indicates the line of sight of the turret/main gun.

- The Alert Sector (outer blue circle) corresponds with the amount of area currently covered by sensors.

- The Countermeasure Coverage Sector (Red sector in inner circle area) corresponds with the amount of area covered by active countermeasures.

    -- The size of the Countermeasure Coverage sector determines how many smoke grenades will be dispensed per salvo and where they will be dispensed in relation to the turret. Specifically: one grenade for every 15 degrees of coverage.

    -- The normal default sector is 60 degrees (4 visual grenades) along the line of sight of the main gun.

    -- The countermeasure sector is set in relation to the turret, **not the hull**.

    -- When the turret moves independent of the hull, the countermeasure sector will reposition itself.

    -- During the launch sequence, the red sector will blink as an indication to the TC that smoke grenades are being dispensed.

- The Safety Sector (Yellow sector in both inner and outer circles) corresponds with the amount of area where activation of any configured countermeasures are disallowed.

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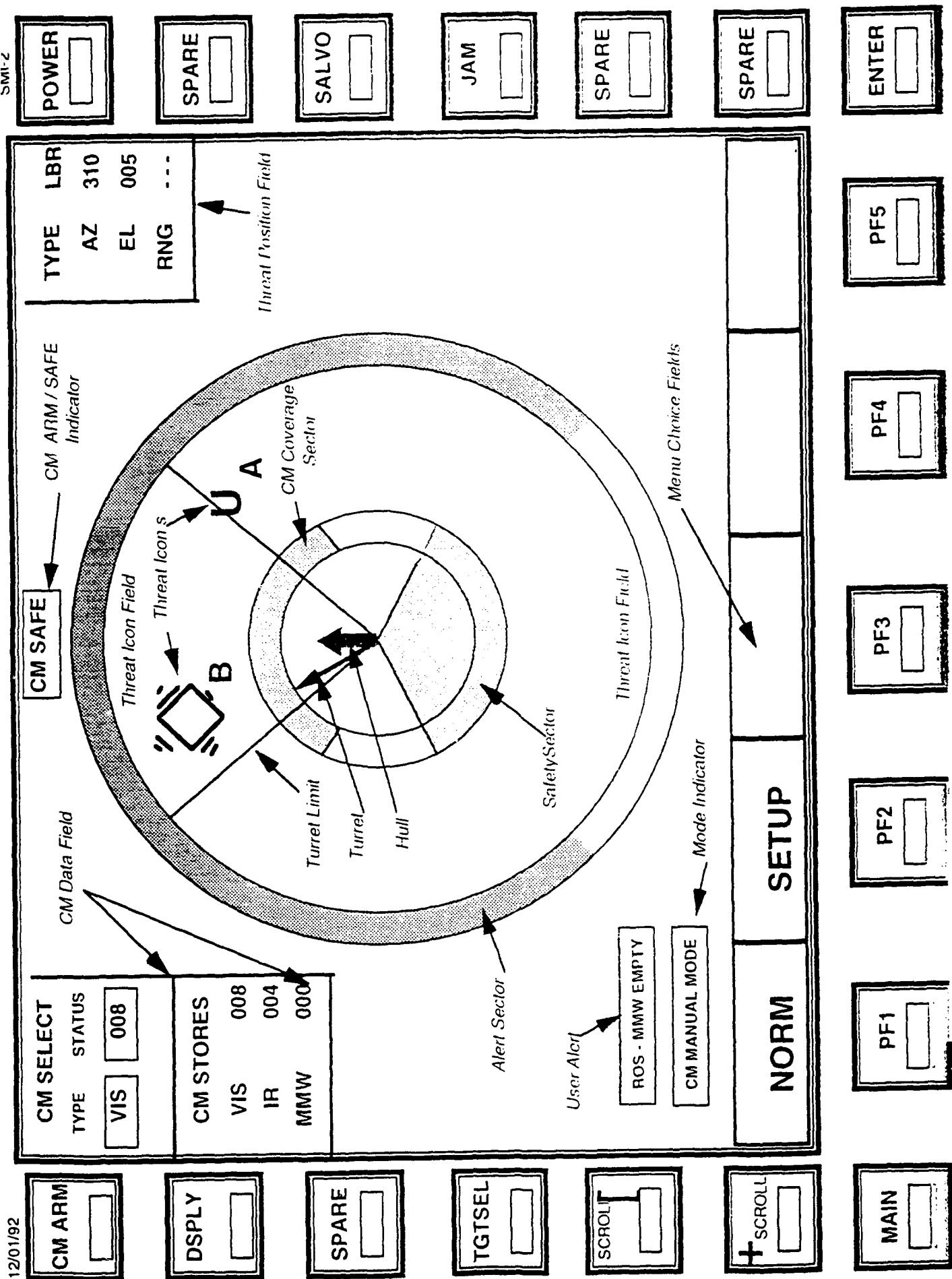
FIGURE 4-1: CCDP Display Format (with Sample Icon Displays)

Buttons: POWER, SPARE, SALVO, JAM, SPARE, SPARE, ENTER
PF5, PF4, PF3, PF2, PF1
CM ARM, DSPLY, SPARE, TGTSEL, SCROLL, SCROLL, MAIN
NORM, SETUP

CM ARM / SAFE Indicator
CM SAFE

Threat Position Field
TYPE LBR
AZ 310
EL 005
RNG - - -

Threat Icon Field
Threat Icons
U A
B

CM Coverage Sector

Turret Limit
Turret
Hull
Safety Sector
Threat Icon Field

CM Data Field
CM SELECT
TYPE STATUS
VIS 008

CM STORES
VIS 008
IR 004
MMW 000

Alert Sector

User Alert
ROS - MMW EMPTY
CM MANUAL MODE

Mode Indicator

Menu Choice Fields

- The Scanning Sector defines the Programmable Turret limits (PTLs) for main gun scanning.

4.1.2   Mode Indicator (in lower left hand corner).

The Mode Indicator Indicates the active VIDS operating mode: Semi-automatic, Automatic, or Manual. Note: When the M1/VIDS is in the manual mode, there is no indicator. Manual mode is the default when the system is powered up. Mode information is only displayed after selecting the NORM PFK.

4.1.3   Threat Icons.

Figure 4-2 shows the legend that defines threat icons currently displayed.

All threat icons are diamond-shaped. The modifier (letter) beneath the icon indicates the threat type:

- An "A" beneath the icon indicates the detection of an ATGM launch.

- A "B" beneath the icon indicates the detection of a Beamrider Missile launch.

- A "D" beneath the icon indicates the detection of a Laser Designated Missile launch.

- An "R" beneath the icon indicates the detection of an enemy vehicle Laser Rangefinder.

If multiple hostile threats of the same type are detected at the same location, VIDS places an icon with a diamond within a diamond on the CCDP. If multiple hostile threats of different types are at the same location, VIDS places the higher priority threat icon on top. The blinking icon represents the highest priority threat.

## 4.1.4   Threat Coordinate Field (in upper right hand corner).

This field displays information about the highest priority threat (i.e. corresponds to the blinking threat icon). Information displayed is the azimuth (AZ), elevation (EL) and range associated to this threat.

If a higher priority threat is detected, the VIDS system will replace lower priority threat information with the higher priority threat information in the threat coordinates field and the new high priority threat icon will be blinking. Information on lower priority threats can be displayed by pressing on the SCROLL UP or SCROLL DOWN FFKs on the left side of the display. This selects threat icons (and associated threat coordinate data) up or down based on the priority scale, not in relation to their position on the display. When this is done, the selected icon will blink and the azimuth and elevation
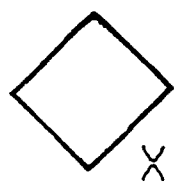
◇ Hostile VIDS Event
X
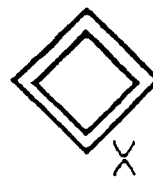
◈ Multiple Hostile VIDS Event
X

If X = A ⟶ ATGM
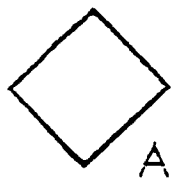X = B ⟶ Beamrider Missile
X = D ⟶ Laser Designator Missile
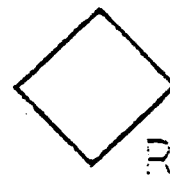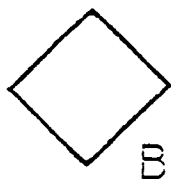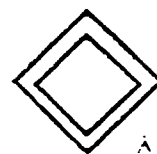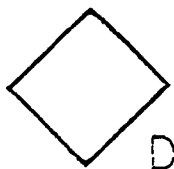X = R ⟶ Laser Rangefinder

Examples

◇ ATGM Launch
A

◇ Tank Laze
R

◇ Beamrider Missile Launch
B

◈ Multiple ATGM Launches
A

◇ Laser Designated Missile Launch
D

◈ Multiple Tank Lazes
R

FIGURE 4-2: Legend of Threat Icons and Examples

information in the threat coordinate field will change to correspond with the blinking threat.

4.1.5   Countermeasure Status Displays

VIDS has several countermeasure status displays to provide status feedback on the smoke grenades and other active countermeasures.

- CM SELECT - information field in the upper left hand corner of display. Displays the type and status (# of rounds) of smoke that will be fired when the SALVO FFK is activated (i.e., what is currently selected).

- CM STORES - information field located directly below the CM SELECT field that displays the type and status (# of rounds) of smoke you have remaining The Multi-Salvo Grenade Launcher (MSGL) holds 32 rounds of VIS and 32 rounds of IR grenades. These 64 rounds are scattered around the vehicle to provide 360 degree coverage.

- CM ARMED/CM SAFE indicator - information field located at the top center of display indicates to the TC, an armed or safe status of currently countermeasures currently configured. Specifically:

  - If CM ARMED appears, VIDS is ready to fire.

  - If CM SAFE, VIDS will not fire any grenades or jam.

4.1.6   Fixed Function Keys (FFKs).

FFKs are the keys that run vertically along the edges of the display.

- FFKs on left side are: CM ARM, DSPLY, SPARE, TARGET, SELECT, SCROLL DOWN, SCROLL UP, and MAIN

- FFKs on right side are: POWER, SPARE, SALVO, JAM, SPARE, SPARE, and ENTER

- The SPARE keys are place holders for future VIDS functions.

4.1.7   Programmable Function Keys (PFKs).

PFKs are the keys that run horizontally along the bottom of the display. Unlike the FFKs that always perform the same functions when you press them, the PFKs vary in function. They are output as displays that are variable depending on previous TC control inputs. As illustrated in Figure 4-1, the top-level PFKs displayed after initialization are: NORM and SETUP.

4.1.8   Alerts and Audible alarms.

Table 4-1 lists alerts and audible alarms currently implemented. Textual alerts are displayed in the lower left hand corner of the display.

TABLE 4-1 ALERTS AND AUDIBLE ALARMS

CONDITION	ALERT
Press SALVO with no grenades left	RND TYPE EMPTY
Scroll up past top threat	SCROLL TOO HIGH
Scroll down past bottom threat	SCROLL TOO LOW
Initiating SALVO or JAM when not in manual Mode	NOT IN MANUAL MODE
Move turret into Safety Zone manually	NO FIRE ZONE
Top threat is in Safety Zone	THREAT IN SAFE
Target selected when no targets	NO TARGETS
SCAN or CM Sector overlaps Safety Zone	SECTOR TOO LARGE
More then 6 targets detected	MORE TARGETS
CM Sector greater then available stores	SECTOR TOO LARGE
Out of grenades	RELOAD CM: VIS RELOAD CM: IR RELOAD CM: MMW
Setup informational displays	SET ALERT SECTOR SET CM SECTOR SET SAFE SECTOR SET SCAN SECTOR
Mode setups in NORM	SEMI: CM, SCAN, and/or CFIRE AUTO: CM, SCAN, and/or CFIRE

CONDITION	AUDIBLE ALARM
New Threat	1 KHZ tone for 3 seconds

4.2 CCDP Inputs.

Except for use of the palm switch (for semi-automatic mode), control inputs to the VIDS system are entered via Fixed Function Key (FFK) and Programmable Function Key (PFK) selections on the CCDP touchscreen panel.

4.2.3 FFK Definitions (clockwise from top right to top left)

To enter a desired FFK selection, put your fingertip on the appropriate displayed button, and the button will highlight. The button is then activated when your fingertip is lifted from the button. FFKs currently implemented are:

- POWER - Controls whether VIDS is in the Off as opposed to the other Operational Modes. When Off, none of the PFKs and only the CM AF. .i and SALVO FFKs are functional. Transition out of Off Mode is to Manual, the top level menu is shown, and all setups are at default values.

- SALVO - Activates one salvo of MSGL/ROS grenades, if in manual mode, and CM ARMED is ON.

- JAM - Activates the MCD, if in manual mode, and CM ARMED is ON

- ENTER - Activates previous PFK selection. If in setup and no PFK selected menu goes up one level.

- MAIN - Puts up the top level menu and sets VIDS to the Manual Mode. Any setup actions are preserved.

- SCROLL UP - If TARGET SELECT FFK is active, this FFK selects the next highest priority target. Attempts to select UP from the highest will result in a User Alert.

- SCROLL DOWN - If TARGET SELECT FFK is active, this FFK selects the next lowest priority target. Attempts to select DOWN from the lowest will result in a User Alert.

- TARGET SELECT - When this FFK is active the current top-priority threat (indicated by blinking icon) is deleted.

- DSPLY - "Declutters" the screen by removing all but active threat icons from the main center body of the display.

- CM ARM - Used in the Manual Mode to activate the CM system currently selected. If Jam or Multi-Salvo Grenade Launcher / Rapid Obscuration System (MSGL/ROS) is selected and if system is in SAFE condition, a user alert is issued.

4.2.4 PFK Definitions

To enter a desired PFK selection, activate the desired button below the display of the desired action, using fingertip as above, but in addition press the ENTER button in the lower right corner to execute desired action. For example, to go into the SETUP menu, press PF2 (under SETUP), then press the ENTER FFK in the lower right corner to execute desired action.

PFK menus are implemented in a hierarchical approach based on the logical order of system functions in a manner that mimics the menu hierarchy documented reference 2.1.a (above) - the ICD for VIDS for Component Advanced Technology Test Bed (CATTB). When the VIDS system is initialized, the top level menu selections displayed are NORM and SETUP:

- NORM - Used to select VIDS operational state (i.e. versus SETUP state). This displays the next level menu selections: SCAN, AUTO, CM and CFIRE.

    -- SCAN - Used to select semi-automatic turret scanning.

    -- AUTO - Used to select automatic mode of operation.

    -- AUTO SCAN - Used to select automatic turret scanning.

    -- CM - Used to activate configured countermeasures in semi-automatic mode.

    -- AUTO & CM - Used to activate configured countermeasures in automatic mode.

    -- CFIRE - Used to activate semi-automatic counterfire.

    -- AUTO & CFIRE - Used to activate automatic counterfire.

    -- AUTO, CFIRE & CM - Used to activate configured countermeasures and counterfire in automatic mode.

- SETUP Used for configuring the display prior to entering a VIDS operational state. While in SETUP, at any time select the Main FFK or ENTER FFK to go back one screen at a time. To get back to the Main Menu, push the Main FFK. The three lower-level menu functions available under the SETUP menu: are ALERT, CM and SCAN.

-- ALERT - Used to define Alert Sector limits to define the area corresponding to the amount of area covered by the MWS or LWR sensors, when in a later operational state.

-- CM - Used to define Countermeasure Coverage Sector limits to define the area corresponding to the amount of area to be covered by the MSGL/ROS and MCD countermeasures, when in a later operational state.

-- SCAN - Used to define automatic turret scanning limits to define the area corresponding to the amount of area to be scanned when selected in a later operational state.

5. CCDP Usage Scenarios

VIDS software uses prioritization rules and threat information to determine the appropriate countermeasure in all modes. These "rules" are identified in Table 5-1. For example, the highest priority threats are those with laser capability, such as laser rangefinders, laser designators, and laser beamriders, in that order. These are countered by the MSGL/ROS. The order in which type of MSGL/ROS smoke is selected is listed first. If the first choice is unavailable, the software then defaults to the second choice. The lowest priority threats are those ATGMs without lasers but which may be jammed using the MCD.

Counterfire is always the last countermeasure employed by VIDS software, after the others have been ruled out due to lack of availability. Counterfire rapidly slews the turret to face the threat so that the gunner can engage the threat with his main gun or with turret mounted countermeasures.

TABLE 5-1 COUNTERMEASURE SELECTION PRIORITY

PRIORITY	THREAT	COUNTERMEASURE (in order)
1	Laser Rangefinder (Round)	Visual Smoke, IR Smoke, Counterfire
2	Laser Designator (Missile)	IR Smoke, Visual Smoke, Counterfire
3	Laser Beamrider (Missile)	IR Smoke, Visual Smoke, Counterfire
4	Missile Launch (No laser)	MCD (jammer), Visual Smoke, IR Smoke, Counterfire

5.1 Using Manual Mode.

5.1.1 Use Multi-Salvo Grenade Launcher (MSGL)/ Rapid Obscuration System (ROS) in manual mode.

- To dispense smoke, press the CM ARM key (upper left FFK) and then the SALVO key (3rd FFK down on righthand side). This will dispense grenades and provide a area of coverage defined by the CM coverage sector.

- The type of and number of grenades dispensed depends on the default parameters or countermeasure parameters established in the SETUP mode.

- In Manual mode, you will only be able to fire your smoke grenades from the launchers located within the CM coverage sector.

- In Manual Mode, VIDS software will provide suggestions for type of round to use in response to the threat in a box in the upper left hand corner.

- The VIDS software indicates recommended selections - what it would select if it in semi-automatic or automatic mode (e.g. fire VIS smoke, etc.) taking into account the remaining stores of countermeasures.

5.1.2 Using the Missile Countermeasure Device (MCD) in Manual Mode

- The MCD is operated by pushing the JAM button after the turret is lined up with the hostile ATGM.

- Once the threat has been defeated, push the JAM button again to turn the MCD off.

5.2 Using Semi-Automatic Mode.

Semi-automatic and automatic modes for countermeasures are only available when there is one or more VIDS sensor (either the LWR or MWS).

In semi-automatic mode, the TC initiates the VIDS when he depresses his palm switch. VIDS software then makes countermeasure or counterfire selections based on threat information from configured sensors. VIDS software generates a 3 second tone in the TC's headset, the appropriate threat icon on the CCDP, and corresponding information about the threat type in the Threat Coordinate Field.

5.2.1   Using Counterfire in Semi-Automatic Mode.

Counterfire is the quickest response to a threat.   If the MSGL/ROS or the MCD are in semi-automatic or automatic mode, the VIDS will employ them before employing counterfire.

- Counterfire is selected by depressing the CFIRE PFK followed by the ENTER FFK. The Mode Indicator should read "Semi:CF."

- To engage the threat with counterfire, the TC then must depress the palm switch on the Commanders Control Handle and hold it in until the VIDS has completed traversing the main gun.

- The turret/main gun will traverse to the hostile target where the gunner can make his final correction and engage the enemy.

5.2.2   Using MSGL/ROS in Semi-Automatic mode.

- Place countermeasures in semi-automatic mode by depressing the CM PFK followed by the ENTER FFK.   The Mode Indicator should read "Semi:CM."

- Engage the palm switch.   VIDS software will take the appropriate countermeasure action based on the sensor's assessment of the threat priority.

- In semi-automatic mode, the VIDS software determines what type of smoke grenade is needed and will fire it off as long as the TC continues to depress the palm switch.   These grenades provide coverage which corresponds to the countermeasure sector between the highest priority target and the host vehicle.   The color of the smoke (Visual smoke is brown, IR smoke is black) indicates which type was employed .

- The SALVO button will highlight while VIDS launches the grenades.

- After smoke grenades are dispensed, VIDS will respond to the next priority threat.   The icon will no longer flash, but will remain on the display.

5.2.3   Using the MCD in Semi-Automatic Mode

- Place countermeasures in semi-automatic mode by depressing the CM PFK followed by the ENTER FFK.   The Mode Indicator should read "Semi:CM."

- Engage the palm switch.   VIDS software will take the appropriate countermeasure action based on the sensor's assessment of the threat priority.

- If the VIDS software selects the MCD as a countermeasure, it will slew the main gun to face the threat, and the MCD will turn on and stay on for 3 sec, or as long as the palm switch is depressed.

- The JAM button will light for the three seconds to let you know that the MCD was activated.

5.2.4 Scanning in Semi-Automatic mode

The Scan mode allows semi-automatic slewing of the turret within a scan se. defined by the commander during the Setup phase or the sector in the systems default memory.

- Semi-automatic scan mode is engaged by pressing the SCAN PFK followed by the ENTER FFK.

- The Mode Indicator should read "Semi:Scan."

- This option will function if the TC keeps the palm switch depressed on the Commanders Control Handle.

5.3 Using Automatic Mode.

When the VIDS counterfire, countermeasure, and scanning functions are in automatic mode, the VIDS software performs automatically in response to a threat. Specifically, the palm switch is not read in this mode. During the performance of an automatic response, the JAM or SALVO Button will be lit as a status indicator to the TC that VIDS is active.

5.3.1 Using Countermeasures in Automatic Mode

The TC has the option to engage the AUTO CM mode which will result in the immediate dispensing of smoke or the use of the MCD once an appropriate threat is detected by the VIDS sensors.

- The automatic mode option is set up by pressing the AUTO PFK followed by the CM PFK and the ENTER FFK. The Mode Indicator should read: "AUTO: CM" .

- VIDS software will then move the next priority threat once the countermeasure is employed.

- Also, the VIDS software does not return to the original LOS once the countermeasures are completed, so the gunner will be pulled off any target that he had acquired prior to VIDS employment of the countermeasures.

5.3.2 **MSGL/ROS in automatic mode.**

- When the VIDS software senses a threat best countered by smoke, the VIDS sensor warning will sound and the threat icon will appear on the CCDP.

- The VIDS will then disperse the required rounds of visual or IR smoke.

- The SALVO button will light up while the smoke is being dispersed.

- If required, automatic turret slewing will be initiated by the VIDS software to provide the correct coverage sector to protect the VIDS/M1.

- If VIDS first choice in grenade type (e.g. visual for a Laser Rangefinder) is used up, the VIDS software automatically defaults to access IR smoke).

- If VIDS is out of all grenades, it will access Counterfire.

5.3.3 **The MCD in Automatic Mode.**

When in automatic mode and no laser is sensed on an approaching ATGM, the MCD will activate automatically.

- The VIDS software automatically slews the turret to line the MCD up with the threat.

- The JAM button will light up and stay lit for three seconds.

- If the MCD is not available, the system will default to MSGL/ROS.

Note: The system does not provide direct feedback on whether the threat missile was successfully jammed by the MCD. However, visually the incoming missile can be viewed as being deflected off course. The VIDS sensors only work upon missile launch detection by the MWS; however, if detected, the MCD is approximately 98% effective.

5.3.4 **Scanning in Automatic Mode.**

Scanning in automatic mode allows the TC to scan a defined sector, without depressing the palm switch.

- Scanning in automatic mode is selected by pressing the AUTO PFK followed by the SCAN PFK, then the ENTER FFK. The Mode Indicator should read: "Auto: Scan".

- The turret will move back and forth between the scan limits set during the SETUP phase.

Note: The gunner has no control of the gun tube while the VIDS is in automatic scan mode.

5.3.5   Counterfire in Automatic Mode.

Counterfire in automatic mode slews the turret to the top-priority threat.

- To engage counterfire in automatic mode, push the AUTO PFK, then the CF PFK, then the ENTER FFK.

- Once the threat is destroyed its icon. must be manually removed via the TGTSEL FFK to automatically engage counterfire for the next threat.

5.4   Icon Deletion

Icons remain displayed on the CCDP until they are manually deleted or no new reports are sensed from that threat for 30 seconds. Use the following manual method to clear icons from screen:

- Highlight the icon using the Scroll Up/down key. (Threat icon should be flashing on and off). This key scrolls up and down the list of threats by priority.

- Touch the TARGET SELECT button to delete the icon and go to the next highest priority target.